

WHAT WE CLAIM ARE:

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5 1. A semiconductor device, comprising a V-groove having V-shaped cross-section on a semiconductor substrate or on an epitaxial growth layer grown on a semiconductor substrate, and an active layer is provided only at the bottom of said V-groove.

10 2. A semiconductor device according to Claim 1, wherein said active layer is sandwiched between a cladding layer inside the V-groove and a cladding layer outside the V-groove, both cladding layers being in contact with each other on a side of said V-groove.

3. A semiconductor device according to Claims 1 or 2, wherein said active layer has a quantum well structure.

15 4. A semiconductor device according to Claim 2, wherein energy gap on the cladding layer outside the V-groove is greater than energy gap on the cladding layer inside the V-groove.

20 5. A semiconductor device according to Claim 1, wherein an inclined surface of said V-groove is a {111} B face.

25 6. A semiconductor device according to Claim 2, wherein an optical guiding layer having a refractive index lower than that of said active layer and higher than that of the cladding layer inside the V-groove is formed between said active layer and said cladding layer inside said V-groove.

7. A semiconductor device according to Claim 6, wherein conductivity type of the cladding layer inside said

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V-groove is different from that of the cladding layer outside said V-groove.

5 8. A semiconductor device according to Claims 6 or 7, wherein conductivity type of the cladding layer inside said V-groove is identical with that of said optical guiding layer.

9. A semiconductor device according to Claims 6 to 8, wherein said active layer has a quantum well structure.

10 10. A semiconductor device according to Claim 6, wherein energy gap of the cladding layer outside said V-groove is greater than energy gap of the cladding layer inside said V-groove.

15 11. A semiconductor device according to claim 6, wherein an inclined surface of said V-groove is a {111} B face.

12. A semiconductor device according to Claim 6, wherein said V-groove is formed by vapor phase etching.

13. A semiconductor device according to Claim 2, wherein said active layer has distortion.

20 14. A semiconductor device according to Claim 13, wherein said active layer has a quantum well structure.

25 15. A semiconductor device according to Claim 13, wherein energy gap of the cladding layer outside said V-groove is greater than energy gap of the cladding layer inside said V-groove.

16. A semiconductor device according to Claim 13, wherein said V-groove is formed by vapor phase etching.

17. A semiconductor device according to Claim 13,

wherein said active layer has distortion.

18. A semiconductor device according to Claim 1,
wherein said epitaxial growth layer is of double hetero
structure with a first cladding layer and a second cladding
layer having refractive index lower than that of a first
optical guiding layer having higher refractive index, said
active layer being in contact with said first optical
guiding layer on a side of said V-groove, and a third
cladding layer having refractive index lower than that of
said active layer being provided on upper portion of said
active layer inside said V-groove.

19. A semiconductor device according to Claim 18,
wherein a second optical guiding layer having refractive
index lower than that of said active layer and higher than
that of said third cladding layer is provided between said
active layer and said third cladding layer.

20. A semiconductor device according to Claims 18 to
20, wherein said first cladding layer and said first optical
guiding layer are of the same first conductivity type, said
third cladding layer and said second optical guiding layer
are of the same second conductivity type, and said second
cladding layer is of second conductivity type or has high
resistance.

21. A semiconductor device according to Claim 18,
wherein said V-groove is formed by vapor phase etching.

22. A method for manufacturing a semiconductor device,
comprising the steps of forming a stripe-like etching
protective film on a semiconductor substrate or on an

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5 epitaxial growth layer grown on said semiconductor substrate, performing gas etching on said semiconductor substrate or on said epitaxial growth layer grown on said semiconductor substrate to form a V-groove with a side surface being a {111} B face, and forming an active layer only at the bottom of said V-groove.

23. A method according to Claim 22, wherein a gas having at least one type of halogen element is used as the etching gas for gas etching.

10 24. A method according to Claim 23, wherein said etching gas is hydrogen chloride, hydrogen bromide, arsenic trichloride, phosphorus trichloride or chlorine.

25. A method according to Claim 24, wherein said etching gas is hydrogen chloride.

15 26. A method according to one of Claims 22 to 25, wherein said substrate is a (100) substrate, and the stripe-like etching gas protective film is formed in <011> direction of said semiconductor substrate.

20 27. A method according to Claim 22, wherein said active layer is formed by organic metal vapor phase growth method.

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